research management findings

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Use of Federal Waterfowl Production Area Wetlands for Rearing Walleyes: Impacts on Macroinvertebrates

By Richard A. Lillie

Introduction

The demand for walleye fingerlings for stocking Wisconsin lakes has increased dramatically in recent years as a result of increased harvest of walleyes by sport-fishing and Native American spearing. Fingerling production has been limited in part by the availability of adequate rearing ponds at state and private hatcheries.

Many of the wetland ponds on federally owned and state-managed Waterfowl Production Areas (WPAs) in northwestern Wisconsin meet the criteria for walleye-rearing ponds: shallow, generally productive, and relatively free of weeds and snags to permit easy harvest by seining. However, proposals to use WPAs for walleye propagation were opposed by state and federal wildlife managers who were concerned that this use would be harmful to waterfowl production.

The first concern was related to fish eradication treatments. State rearing ponds are treated with fish toxicants prior to stocking walleye fry in order to remove predator fish and thereby optimize fry survival. But these toxicants are not normally applied to open wetlands. Also, the fish toxicants used in this study are known to have immediate, but generally short-lived, impacts on non-target organisms, including invertebrate communities (Schnick 1974). Consequently, wildlife managers were concerned that the toxicants could adversely affect the macroinvertebrate food base essential to successful waterfowl production and brood survival.

Managers were also concerned about competition between walleyes and waterfowl for macroinvertebrates. Walleyes feed primarily on zooplankton until they reach about 100 mm in length; then they feed primarily on fish (Walker and Applegate 1976). But if zooplankton and minnows are not available, walleye fingerlings may feed on macroinvertebrates, thereby reducing available food for waterfowl. A third major

Table 1. *Timeline of fish management applications.**

Pond	Treatment	1989**	1990	1991	1992
Treatment:					
Clapp-center	Stocking		✧	✧	✧
	Harvest		✧	✧	✧
	Eradication	✧	✧	✧	
Deer Park-south	Stocking			✧	✧
	Harvest			✧	✧
	Eradication	✧	✧	✧	
Reference:					
Clapp-east	None				
Deer Park-north	Stocking		✧		
	Harvest		✧[a]		
	[Winterkill]	✧			
Bierbrauer	None				
	[Winterkill]	✧			
Erickson	None				
	[Winterkill]	✧			

* Data provided by DNR Western District Fisheries Management staff. Fish eradication with either Rotenone or Antimycin in fall; stocking in early May; initial harvesting in June with follow-up harvests in July or August. All stocked ponds received fertilization with alfalfa meal weekly between stocking and harvest.

** Pretreatment year.

[a] No fish were recovered when Deer Park-north was harvested in 1990. Deer Park-south was treated in fall 1989, but not stocked in 1990.

Table 2. *Medians and ranges (in parentheses) in water chemistry variables on WPA wetlands during 1989-92 (2 sample dates per year).*

Pond	pH (units)	Color (units)	Turbidity (FTUs)	Chlorophyll-*a* (µg/L)	Alkalinity (mg/L)	Conductivity (µmhos/cm)
Treatment:						
Clapp-center	8.4 (7.3-9.3)	25 (15-45)	2.1 (1.5-4.4)	5 (3-19)	166 (145-201)	349 (294-383)
Deer Park-south	7.7 (7.3-8.3)	70 (20-80)	2.2 (1.3-3.4)	7 (6-19)	45 (34-82)	165 (114-182)
Reference:						
Clapp-east	8.6 (7.7-9.0)	20 (10-50)	1.5 (1.3-4.2)	3 (2-57)	135 (119-146)	301 (260-311)
Deer Park-north	7.1 (7.0-9.7)	120 (70-160)	4.0 (1.2-7.0)	11 (7-209)	51 (42-60)	179 (158-208)
Bierbrauer	8.7 (8.3-9.6)	30 (15-60)	2.4 (1.4-5.9)	8 (4-35)	135 (113-128)	283 (239-254)
Erickson	8.4 (7.4-9.4)	45 (15-90)	5.6 (2.1-11.0)	22 (2-84)	118 (87-138)	261 (236-274)

concern was that human activities associated with eradication, stocking, weekly fertilization, and harvesting would directly disturb waterfowl, disrupting broods or causing hens to abandon their nests.

In 1989, the U.S. Fish and Wildlife Service issued the Wisconsin Department of Natural Resources (DNR) a special-use permit to rear walleyes on 2 WPA wetlands in St. Croix County to evaluate the impact of walleye rearing on macroinvertebrate abundance and community composition. These evaluations were conducted cooperatively during 1989-92 by the U.S. Fish and Wildlife Service and the DNR Bureaus of Research, Wildlife Management, and Fisheries Management, in conjunction with an ongoing wetland-waterfowl research project on nearby wetlands (Evrard and Lillie 1987).

Methods

Six WPA wetland ponds were selected for study based on a combination of knowledge of existing biota and criteria established by fisheries managers for walleye-rearing habitat. Table 1 identifies the management applications each wetland received one year prior to treatment (1989) and during a 3-year treatment phase (1990-92). Two treatment ponds (Clapp Pond-center and Deer Park-south) were used for walleye rearing, while 4 ponds served as regional (Erickson and Bierbrauer) or local (Clapp Pond-east and Deer Park-north) reference ponds. The regional reference ponds had been sampled continuously since 1983 (Evrard and Lillie 1987) and served as trend indicators for the effects of climatic change on macroinvertebrate communities within the region. Both regional reference ponds experienced total fish-kills in 1988-89, following natural drawdown caused by the drought of 1987-88.

Water chemistry and macroinvertebrate communities were monitored in each pond in May and June, 1989-92, periods roughly corresponding to walleye stocking, initial walleye harvest, and peak waterfowl nesting and brood-hatching. Details on sampling procedures and laboratory methods are provided in Evrard and Lillie 1987. Statistical differences ($P < 0.05$) among macroinvertebrate densities were computed using the ANOVA/Tukey (HSD) procedure (SAS 1988).

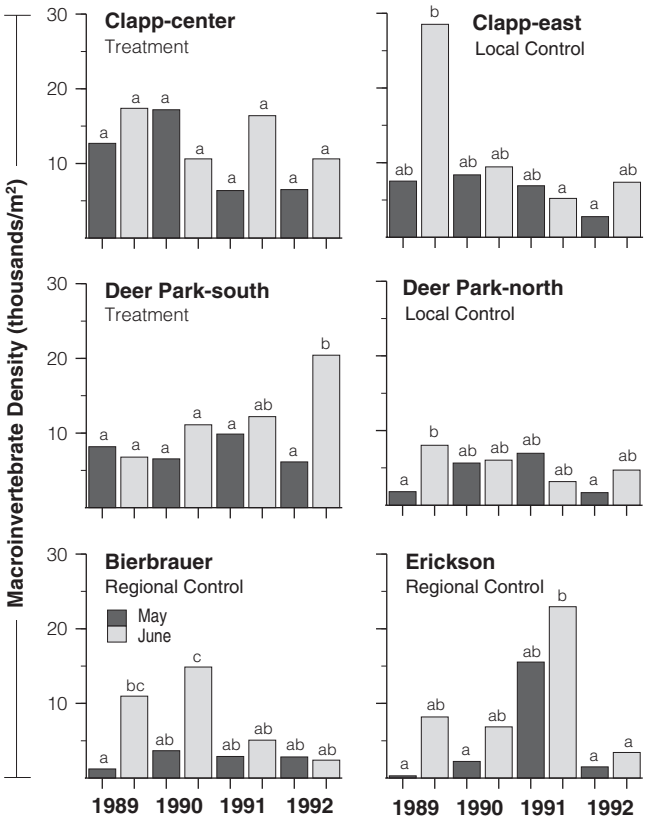

Figure 1. *Comparisons of total macroinvertebrate densities among dates within ponds (1989 was pretreatment). Densities in ponds with common letters are not significantly different at* $P < 0.05$.

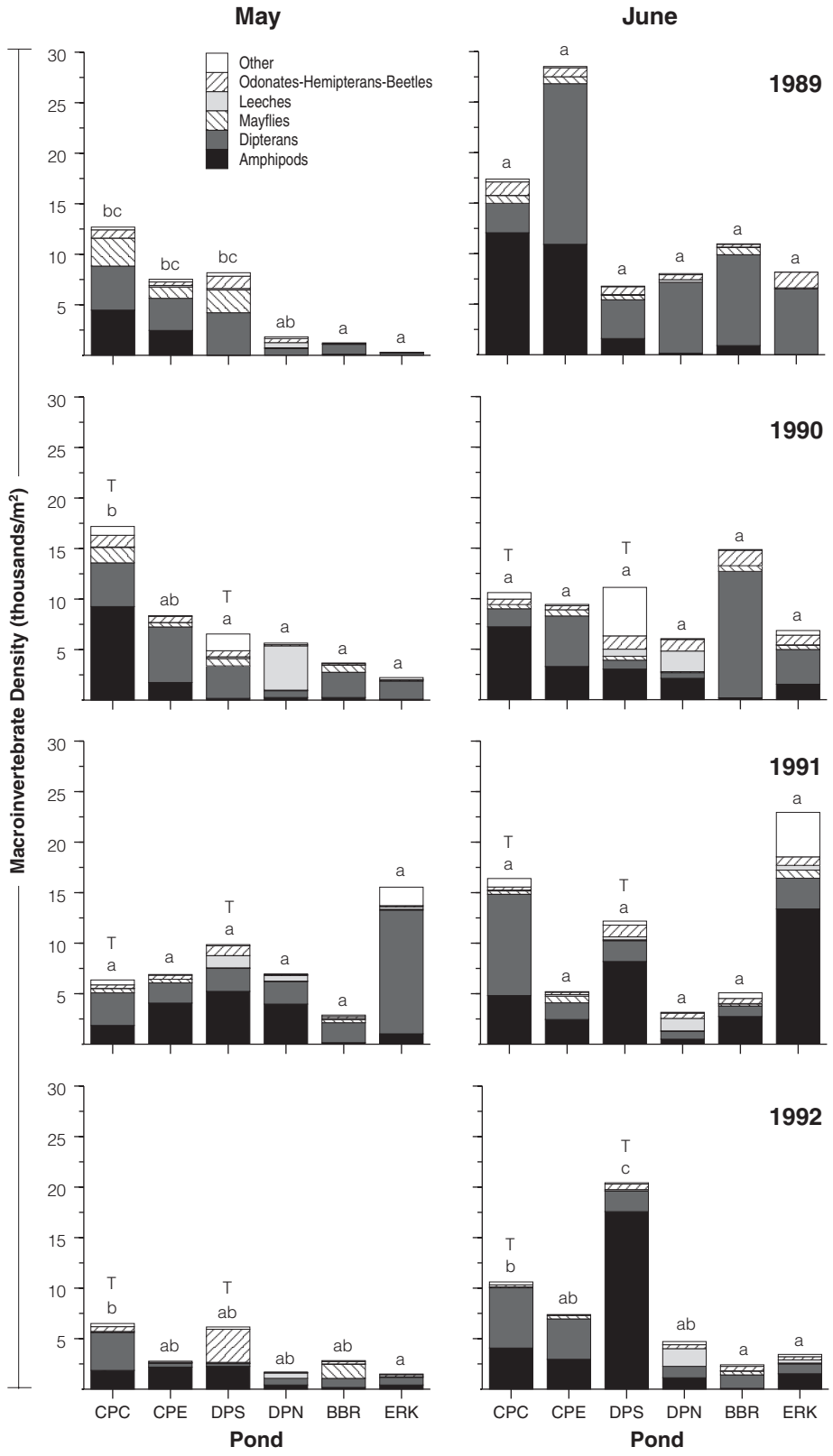

Figure 2. *Comparisons of total macroinvertebrate densities and community compositions among ponds by date (1989 pretreatment). Densities in ponds with common letters are not significantly different at* P < *0.05. Treatment ponds are designated by a* T.

Results and Discussion

Water chemistry fluctuated quite widely in all ponds during the study (Table 2), but few changes were associated with treatments. Color, turbidity, pH, and chlorophyll-*a* concentrations exhibited similar ranges in seasonal variability among all ponds. No differences or trends could be attributed to treatments, and despite the addition of fertilizers, chlorophyll-*a* peaks were lowest in treatment ponds.

Total macroinvertebrate densities were not affected adversely by the treatments, as indicated by changes occurring within ponds over time (Fig. 1) and comparisons among ponds by date (Fig. 2). Macroinvertebrate densities did not change significantly after treatments began in Clapp Pond-center and actually increased in Deer Park-south (June 1992). Macroinvertebrate densities were never significantly lower in treatment ponds than in local or regional reference ponds. In fact, during the last year of the study (1992), both treatment ponds had the highest macroinvertebrate abundances, with densities in Deer Park-south significantly higher than all other ponds.

Macroinvertebrate composition varied substantially in treatment ponds and reference ponds during the study period (Fig. 2); however, no changes could be directly attributed to treatments. Compositional changes occurring within the 2 regional reference ponds were roughly similar to, but much more variable than, changes occurring within the treatment ponds. Dipterans or amphipods were dominant on both Clapp Pond-center and its local reference, Clapp Pond-east. Stocking on

Deer Park-south, which began in 1991, did not seriously impact the macroinvertebrate community. The increased dominance of amphipods was not accompanied by a decrease in density of other taxa.

This study focused only on total macroinvertebrate abundance and composition. Several potentially significant topics were not addressed but warrant further research. For example, differences in the size structure and composition of the macroinvertebrate communities were not studied, nor were the possible secondary, indirect effects that fish-rearing activities may have had on the availability of food resources to waterfowl. This study also did not address disturbance to waterfowl caused by fish management activities; possible impacts on waterfowl that feed extensively on zooplankton (e.g., northern shovelers); or the long-term effects of treatments, fertilization, and disturbance to macrophyte communities.

Management Implications

In this study, the use of WPA wetlands as walleye-rearing ponds had no apparent adverse impact on either water chemistry or macroinvertebrate communities. The limited data gathered suggest that fish eradication treatments in fall, stocking of walleye fry in early spring, and harvesting of fingerlings in summer did not reduce total macroinvertebrate densities or affect community composition beyond normal expected variations. These conclusions may not be valid for stocking rates in excess of those used in this study or under conditions that would limit the abundance and availability of natural food resources below the levels found in the ponds during the study period.

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